Remarks

Paragraph 0024 has been amended to correct a typographically error; as is apparent from the context of the sentence, the word changed should be "significantly" rather than "insignificantly."

New dependent claims 38 and 39 recite that the second multilayer film has a thickness that is at least two times that of the first multilayer film. Support is found, for example, in paragraph 0025 of the specification and original claim 30.

Claim 1 has been amended to include the limitation that the source of radiation generates EUV; this recitation was found in original claim 4.

Claims 1 and 15 have been amended to include the limitation that the underlying reflective surface comprises a first multilayer film that is deposited on a surface of the substrate and wherein the sacrificial reflective surface is a second multilayer film that is deposited on a surface of the underlying reflective surface. This recitation was found in original claims 6 and 19. In addition, both claims 1 and 15 have been amended to include the limitation that the underlying reflective surface has a normal incidence reflectivity of at least about 30% of the EUV radiation. This recitation was found in original claims 5 and 18. Finally, claims 1 and 15 have been amended to include the limitation that the presence of the upper sacrificial reflective surface does not enhance the reflectance of the at least one collection mirror. Support for this amendment is found, for example, in paragraph 0025 of the specification.

Claims 1-7, 10-20 and 23 were rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,469,827 to Sweatt et al in view of US Patent 6,833,223 to Shiraishi.

Sweatt is said to teach a condenser system having a set of mirrors for collecting extreme ultra-violet radiation from a radiation source that forms a source image and

having correcting mirrors which are capable of translating or rotating or both, one or more beams from said set of mirrors and are capable of modifying the convergence of the one or more beams or the size of the source image, or both.

Sweatt however is said not to teach that the system includes at least one collector mirror facing a source of EUV radiation wherein the at least one collector mirror comprises a substrate, an underlying reflective surface and an upper sacrificial reflective surface. In regard, the Examiner stated that Shiraishi teaches at least one collector mirror facing a source of EUV radiation wherein the at least one collector mirror comprises a substrate, an underlying reflective surface and an upper sacrificial reflective surface. While the Examiner conceded that the prior art did not specifically teach the claimed sacrificial surface, the Examiner nevertheless reasoned that this feature was seen to be an **inherent** teaching of that device since it was apparent that the topmost layers of mirror being exposed to the corrosive environment in the chamber would be eroded or sacrificed.

The Examiner concluded that it would have been obvious to one having ordinary skill in the art at the same time the invention was made to utilize the collector mirror of Shiraishi in the condenser system of Sweatt et al in order to provide for a multilayer film mirror that exhibits high reflectivity to incident radiation independently of the angle of incidence.

Finally, claims 8, 9, 21, and 22 were also rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6,469,827 to Sweatt et al in view of US Patent 6,833,223 to Shiraishi. Specifically, the Examiner contended that Sweatt et al in view of Shiraishi taught the claimed invention of claims 9 and 22 as Shiraishi is said to teach that the first multilayer film has a periodicity of about 5nm. Although the Examiner indicated that Sweatt et al in view of Shiraishi did not teach that the first multilayer

film comprises about 20 to 80 pairs and the second multilayer film comprises about 100 to 400 layer pairs as defined in claims 8 and 21, nevertheless the Examiner concluded that it would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the number of layer pairs of the multilayer film, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Even assuming that Sweatt et al. teaches the art as suggested by the Examiner, Applicants submit that the deficiencies of the primary reference are not cured by Shirasihi which is alleged to improve on the shortcoming multilayer film mirrors by providing a multilayer film which is said to exhibit high reflectivity to incident x-ray independent of the angle of incidence and without deteriorating optical performance of the mirror. (Col. 3 lines 49-55.) Shirasihi's multilayer film is formed of alternating superimposed layers of a first and a second material; the alleged improvement is derived by varying the ratio of the thickness of the respective layer of the first material to a thickness of the layer pair in at least one of the layers pairs of the film. (Col. 4 lines 5-8.)

Shirashihi further depicts in Figure 2 an exemplary x-ray lithography tool in which the improved mulilayer film can be used. The lithography tool includes a laser-plasma light source 7 and disposed immediately upstream of the laser-plasma source 7 is a paraboloid mirror 11. (Col. 8 lines 15-19 and 33-35.) Downstream from the laser-plasma source 7 is an exposure chamber 33 which contains an illumination-optical system 17 that comprises mirrors. EUV radiation is shaped by the illumination-optical system 17 into a circular flux that is directed toward mirror 19. (Col. 8 lines 46-65.)

Shirasihi goes on to state that his improved mirrors as shown in Figs 1A and 1B "can be used, for example, as the x-ray-reflective mirror 19 and/or the x-ray-reflective mirror 11 in the lithography tool 1 shown in FIG. 2." (Col. 9 lines 52-55.)

As is apparent, in constructing his multilayer film reflective mirror, Shirasihi does not distinguish mirror 11, which is associated with the laser-plasma source, from mirror 19 which is further downstream. In particular, there is no suggestion of making mirror 11 thicker, i.e. having more alternating layers of high and low refractive index material, in consideration of the corrosive environment in the exposure chamber wherein mirror 11 is exposed as the Examiner has suggested.

MPEP 2112 sets forth the requirements when a prior art can be cited in rejecting claimed subject matter on the basis that the prior art is silent as to an inherent characteristic. Specifically, MPEP 2112 states, among other things that:

> The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); In re Oelrich, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted) (The claims were drawn to a disposable diaper having three fastening elements. The reference disclosed two fastening elements that could perform the same function as the three fastening elements in the claims. The court construed the claims to require three separate elements and held that the reference did not disclose a separate third fastening element, either expressly or

inherently.). Also, "[a]n invitation to investigate is not an inherent disclosure" where a prior art reference "discloses no more than a broad genus of potential applications of its discoveries." Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings, 370 F.3d 1354, 1367, 71 USPQ2d 1081, 1091 (Fed. Cir. 2004) (explaining that "[a] prior art reference that discloses a genus still does not inherently disclose all species within that broad category" but must be examined to see if a disclosure of the claimed species has been made or whether the prior art reference merely invites further experimentation to find the species.

"In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original) (Applicant's invention was directed to a biaxially oriented, flexible dilation catheter balloon (a tube which expands upon inflation) used, for example, in clearing the blood vessels of heart patients). The examiner applied a U.S. patent to Schjeldahl which disclosed injection molding a tubular preform and then injecting air into the preform to expand it against a mold (blow molding). The reference did not directly state that the end product balloon was biaxially oriented. It did disclose that the balloon was "formed from a thin flexible inelastic, high tensile strength, biaxially oriented synthetic plastic material." Id. at 1462 (emphasis in original). The examiner argued that Schjeldahl's balloon was inherently biaxially oriented. The Board reversed on the basis that the examiner did not provide objective evidence or cogent technical reasoning to support the conclusion of inherency.).

Applicants submits that, with respect to the subject matter as defined by amended independent claims 1 and 15, the presence of an upper sacrificial reflective surface over an underlying reflective surface and does not **necessarily flows** from the teaching of Shiraishi. Both claims 1 and 15 now recite that the underlying reflective surface has a normal incidence reflectivity of at least about 30% of the EUV radiation and that the presence of the upper sacrificial reflective surface does not enhance the

reflectance of the at least one collection mirror. As discussed in paragraphs 0024 and 0025of the specification, the EUV reflectance of a multilayer stack has a maximum which will not improve even if the number of bilayers in the stack is increased. The sacrificial reflective surface serves to prolong the useful life of the EUV collection mirror and not to enhance its reflectance.

In his background portion in column 3, lines 10-45, and Figure 7, Shiraishi describes an embodiment of a conventional Mo/Si multilayer film with 50 layer pairs. In describing Fig. 7, the reference stated:

> As can be seen in FIG. 7, the period length and total film thickness at which reflectivity is highest are approximately 68.28 Å and 3413 Å (50 layer pairs), respectively, whenever the angle of incidence is 0.degree.. Whenever the angle of incidence is 10°, the period length and total film thickness at which reflectivity is highest are approximately 69.31 Å and 3466 Å (50 layer pairs), respectively. Consequently, in order for reflectivity to be at its highest at the various angles of incidence, it is necessary to make the period length approximately 1 Å larger, at points at which the angle of incidence is about 10 °, than at points at which the angle of incidence is about 0 °. Now, Mo/Si multilayer coatings on EUV-reflective multilayer-film mirrors generally comprise 50 layer pairs. **Locally increasing the period length on a multilayer coating as summarized above would create a difference of 4.7 nm in the total film thickness of the multilayer coating, which would impose a corresponding change in the surface profile of the multilayer-film mirror.** Since the magnitude of this change exceeds what can be tolerated from the standpoint of wavefront aberration of light reflected from the mirror, such changes can significantly deteriorate the optical performance of an EUV optical system including such a mirror. Col. 3 lines 23-45. (Emphasis added.)

Applicants submit that Shiraishi, in describing his own invention, would not have increased the number of alternative bilayers significantly beyond that which is necessary to achieve maximum reflectivity in view of his concerns that increasing the thickness of the multilayer coating can adversely affect the surface profile of the film.

In view of the foregoing, applicants submit that the pending claims define novel and non-obvious subject matter.

Respectfully submitted,

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